DARLINGTON'S

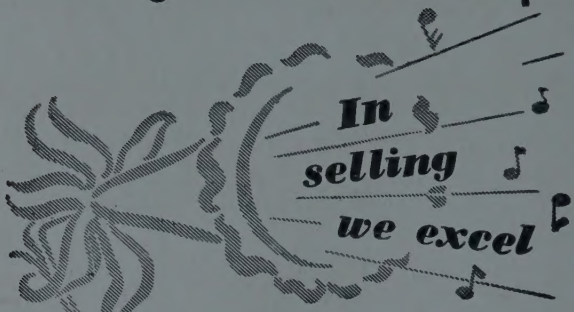
Mushroom News

A QUARTERLY JOURNAL FOR MUSHROOM GROWERS

Vol. VIII No. 6 OCTOBER 1961

29 NOV 1961

Blowing our own trumpet



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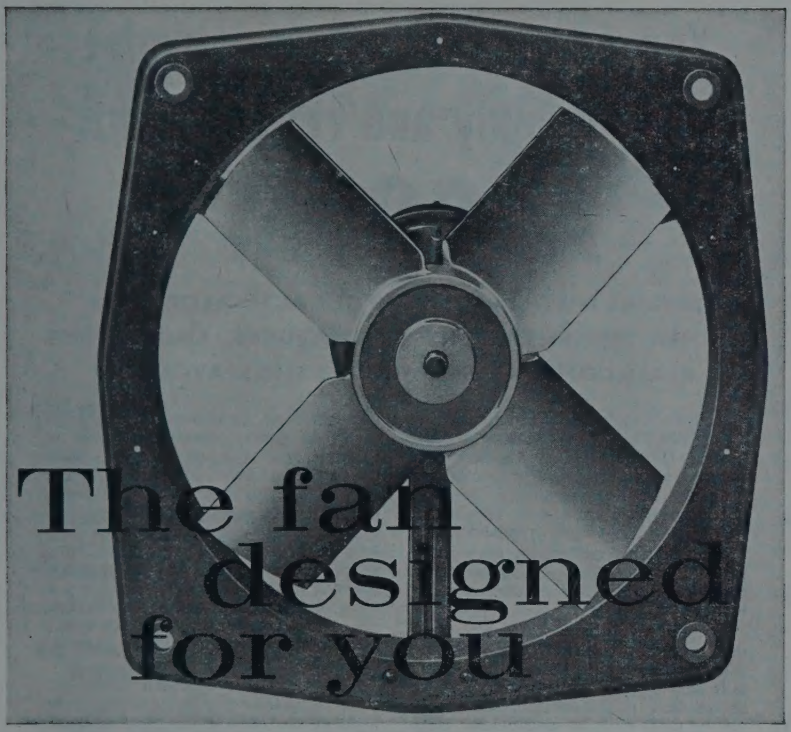

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Mushroom News

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OUR FRONT COVER

Our truly delightful front cover shows Mrs. Wendy Garrett, the Assistant Secretary of the Mushroom Growers Association sampling a raw mushroom. The use of raw mushrooms as a garnish to salads and soups must be encouraged as part of any campaign to popularise them.

Mushroom News is issued free of charge to all Registered Mushroom Growers. Applications for registration should be addressed to the publishers, W. Darlington & Sons Ltd., Worthing, Sussex, England. The publishers are unable to accept any responsibility for statements made or views expressed or for any advertisements appearing in this journal.

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Mushroom News

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WORTHING ENGLAND

Vol. VIII No. 6 **OCTOBER 1961**

The boiler house has become the heart of the modern mushroom farm. A grower, planning a new farm, should start by siting his boiler house, and should bear in mind all foreseeable developments. The heating unit will provide heat for growing houses and heat rooms, but it must also have sufficient capacity to cook out houses, and if necessary sterilise trays, casing materials and so on.

Obviously if the job is to be done properly the detailed planning will be beyond the capabilities of the grower himself. He should call on the services of a qualified heating engineer, preferably one with practical experience of the mushroom industry. Together they will agree on the capacity of the heating unit required, and from our experience the grower will not go far wrong if he doubles this estimated figure! Excess capacity can be absorbed by expansion, but if there is not enough heat at the start, the mushroom farm will always be handicapped.

To the grower struggling with a hand-fired hot-water boiler, 4 inch pipes, a hit or miss pasteurising set-up and no facilities for cooking out, the prospect of adequate heating is a pipe dream in more senses than one! Yet it may be the margin of survival in the next few years, and he would do well to concentrate on obtaining all the heat he needs and more.

One way of obtaining help is to apply for a grant under the Horticultural Improvement Scheme, now forgotten by many growers yet still capable of handing out some £5,000,000. A grant will be made to "improve" heating and this can be interpreted as completely replacing an existing, inadequate system, provided the replacement system does not include extensions. The Improvement Scheme is aimed at increasing *efficiency* rather than increasing *production* and certainly one of the quickest ways of making the average farm more efficient is to tear out its boiler and piping and replace them with something more contemporary. While the grower must find two-thirds of the cost of the improvement, the remaining third is a free gift without strings,

As we have remarked before, the day of the improvisation has ended for the mushroom grower and if he is to survive in the future he must make his growing methods efficient. Adequate supplies of heat are essential on the mushroom farm, and if they are not there, the farm is neither modern nor efficient.

Notes and News

Research

Dr. F. T. Last of the Rothamsted Experimental Station has been appointed head of the Mycological and Bacteriological Department at Glasshouse Crops Research Institute, Littlehampton. Mr. P. H. Williams, who held the appointment, has retired after 38 years in glasshouse research.

Delivered Damaged

Growers know how difficult it is to find out how their so carefully packed produce arrived at the market damaged. Somewhere along the line it took a knock—but where?

"Horace" will help in future. "Horace" is the nickname of the Patra Drop Recorder, introduced by the Printing, Packaging and Allied Trades Research Association.

It is an instrument that records bumps suffered by a package, and shows the time at which they occurred. The instrument is concealed in one of the produce containers, suitably buffered in cushioning material, and sent off to market. Examination on arrival will show the exact time when the container was hurled twenty feet through the air to land on one corner. Knowing the time, it will not be difficult to find out who threw it!

Mushrooms in Ulster

It is estimated that the production of mushrooms in Northern Ireland in 1960 reached a total of three-quarters of a million pounds, valued at some £135,000, giving an average price of 3s. 7d.

This represents an increase of 50% on the production figure for 1950, and the average price received has, if anything, increased by a fraction of a penny.

Almost the whole of the production of Northern Ireland is sent to the wholesale markets of north-west England and central Scotland, although relatively small consignments are beginning to appear further afield.

H.M.C. Report No. 1

The first annual report of the Horticultural Marketing Council was laid before Parliament at the beginning of August. This body is going to play an increasingly important part in the future development of the horticultural industry, and growers are advised to keep in close touch with its activities.

The report stresses the trend towards lightening the housewife's task. She is probably going out to work and she wants meals that are quick and easy to prepare. The Council accuses the industry of being slow to adapt itself to this trend, and warns that those who do not supply produce requiring little preparation will find themselves in difficulties.

The second point made in the report is that horticultural produce receives far less attention than its competitors who make use of modern advertising, particularly television advertising. The Council is convinced that publicity and advertising of horticultural products must be undertaken on the widest possible scale.

At the moment the Council is supported by public funds, but when it can raise its own charges it pledges itself to tackle this problem immediately, and in fact has already commissioned a survey of the pattern of demand.

REPORT ON

A.F.D.

ACCELERATED FREEZE DRYING

Although freeze drying has been in use for some years in the pharmaceutical and microbiological fields, it is only recently that it has become a commercial possibility for food preservation. Produce dried by A.F.D. and protected by moisture-proof wrappers, has a remarkably long shelf life and requires no special conditions for storage. The method, in which Britain is first in the field both as regards development and equipment, has been described as the biggest advancement in food technology since canning was invented a century and a half ago.

The preservation of foodstuffs by drying has been practised for thousands of years, but it is only recently that real progress has been made in preserving in the dried product the flavour and texture of the original. Dried fruits have a distinctive flavour of their own, and to return them to an edible condition requires several hours of soaking and heating. Dehydrated foodstuffs, such as potato and egg, were widely used during the Second World War and unfortunately earned a bad name for a process that had considerable possibilities.

'Drying' a product by hot air or vacuum entails the movement of moisture from the centre outwards, and in its movement the moisture carries with it many of the soluble contents of the cell. This continuous movement of water and salts alters the make-up of the product, causes shrinkage and leads to the formation of a hard outer skin that slows down further drying and makes subsequent remoistening for eating a lengthy business.

Now there is a natural process known as sublimation in which a solid such as ice turns into vapour without the necessity of passing through an intermediate liquid stage. This process of sublimation is demonstrated in most domestic refrigerators, where the ice cubes will be found to shrink with time, as they give off the frozen water directly as vapour.

Freeze drying consists basically of freezing the water in the food product, and then converting the ice directly into vapour. In this way there is no movement of moisture in the product—only of vapour—and consequently it has little effect on flavour, structure, nutritive value, appearance and colour. There is no shrinkage of tissue, so the form is preserved, and when it is wished to reconstitute the product by soaking in water there is no impervious skin to penetrate and reconstitution takes only a matter of minutes.

To achieve freeze drying the food is placed on trays and frozen to -20°C in an air blast freezing unit.

All the moisture in the product is now converted into ice, and the second stage is to remove this ice without damaging the product. As we have mentioned, this can be done under ordinary atmospheric conditions but it would take an inifinity of time. If, however, the pressure is reduced, then the process of sublimation takes place more rapidly without damaging the product.

The trays are therefore placed in a special chamber and the air pressure is lowered to an absolute pressure of 1 mm of mercury, which is just about as complete a vacuum as can be obtained. Sublimation of the ice into vapour commences, but progresses slowly and in order to speed it up, heat is applied under controlled conditions so that the product is not affected.

As so often happens in this strange scientific world in which we live, it is the problem of applying the heat to the product that has given the development engineers their biggest worries. Until recently no satisfactory method could be found, and drying times were so protracted that there was no prospect of commercial application.

At last a break-through was made, and practical methods of applying sufficient heat to the product were evolved. Most of the work on this problem in Great Britain has been along the lines of heating by direct contact under pressure, and units offered for sale in this country use this method of heating.

The heating apparatus in the drying cabinet consists of a number of parallel heating plates between which the food is placed. The plates are interconnected so that close contact is made between each plate and the top or bottom of the layer of frozen food.

Each layer of the food is sandwiched between sheets of expanded metal mesh. This sheet has the dual purpose of subjecting the product to increased pressure over a wider area, while still allowing room for the vapour to escape.

Some idea of the problem can be conveyed to the reader if he imagines a large steak frozen rigid, which has to be heated. It is no use applying heat from below because there is no air (or air currents) in the vacuum to warm the steak. If the steak is pressed tightly between two flat steel plates which are heated, then heat passes into the steak, but there is no way for the vapour to escape except at the edges. By using expanded metal mesh, the pressure and contact are maintained, so that heat is passed, but the moisture can escape easily from the steak.

When the frozen food is placed in the drying cabinet at a temperature of -20°C, it takes about 5 minutes for the pressure to be lowered to 1 mm, and during this time the temperature of the food falls another 10°C. At this point the supply of steam heat is turned on, and the heating plates begin to warm. After 15 minutes they reach 140°C, and this temperature is held for about 30 minutes, after which the plates are allowed to cool off slowly.

As drying progresses the pressure on the product is increased, and drying is completed when the temperature of the product is equal to the temperature of the plates. The actual drying process takes anything from 4 to 8 hours, depending upon the nature of the food being processed.

This is a broad outline of the method of accelerated freeze drying of foodstuffs. Development work on the process was first carried out at

the Ministry of Agriculture, Food and Fisheries Research Establishment at Aberdeen, and then the Vickers Group and Unilever Group became interested in the possibilities. The Unilever Group took over the Aberdeen station and is preparing to launch freeze dried food products on to the market through its subsidiary, Batchelors.

The Vickers Group are manufacturing accelerated freeze drying equipment at the Vickers-Armstrong South Marston Works, and can offer either a pilot plant or a full-scale operating plant. They have installed a three-unit plant for the Irish Sugar Company in Eire, where freeze drying of a wide range of agricultural and horticultural products is being carried out, some of which have been used for United Nations troops in the Congo.

Mushrooms and A.F.D.

Tests with mushrooms have shown that they respond satisfactorily to A.F.D. treatment, and their 88 to 90 per cent moisture content can be removed in about 7 to 8 hours. After drying they are of good colour and unblemished, although there might be some marking from the slight pressure of the expanded metal plates.

To reconstitute, the mushrooms are immersed in water for five minutes; on cooking they are indistinguishable from a random sample of fresh mushrooms. The flavour is excellent—some say even more pronounced than in fresh mushrooms—and if there was a slight leatheriness, it may be due to delay between picking and processing, a fault that can be easily rectified.

Foodstuffs dried by A.F.D. contain only about 2 per cent moisture, and consequently they will take up moisture from the air unless stored in moisture-proof containers. These can be of metal, but there is no reason why plastic film should not be used if it is moisture-proof. This ease of storing is a fundamental advantage of A.F.D., for it has very obvious advantages when compared with canned goods or deep frozen foods. Provided moisture is excluded, A.F.D. foods can be stored for up to 12 months without deterioration, so giving vastly extended shelf-life to the product from the vendor's angle.

Costs

A pilot plant costs about £5,700, but with a throughput of 35lb. of wet food every 8 hours, or 105lb. per 3-shift day such an investment would not be justified except as part of a large-scale project study.

A large unit, such as one of the three installed by the Irish Sugar Company, costs £35,000, and can process 25 cwt of wet food per day. The operating cost of removing one pound of ice from a product is about 1.1d., and this does not include overheads and depreciation, so that it can be seen that the process does not as yet come into the 'back-yard' category. In the case of mushrooms, the price for a pound of dried mushrooms would be around 45/- if the process was to be economically attractive.

Conclusion

Accelerated Freeze Drying is now a practical proposition, and as such offers serious competition to canning and deep freezing of certain foodstuffs. Nevertheless the high capital cost of the equipment offers little opportunity to individual growers to consider installation and it appears inevitable that development of the process will be made by existing food processors.

" Like some husbands, humidity can claim to be a much misunderstood and much neglected subject, and like some wives, it will probably repay careful consideration."

TALKING ABOUT HUMIDITY

by

L. P. SMITH

Humidity is an important factor in plant growth and in the incidence and spread of plant diseases. Of all commercial crops mushrooms are, perhaps, most sensitive to fluctuations in humidity and no doubt for this reason it suffers more than its fair share of blame in mushroom growing yet it is surprising how few mushroom growers understand just what humidity is, how and why it varies and its close relationship to temperature. In this article Mr. L. P. Smith, who is well-known for his articles on the weather, elucidates some of the complexities of this far from simple atmospheric condition.

"Everyone talks about the weather in England, but no-one does anything about it." A fair comment, one might think, but it hardly does justice to growers, who are constantly doing something about it, especially if they are concerned with crops such as mushrooms. They have, in fact, three major problems; they want to know what the weather is, they want to know what the weather should be to grow good crops, and they want to know how to convert the former to the latter.

The simplest of these problems should be the first one—what is the weather in Britain? Nevertheless its very simplicity is misleading. The weather we enjoy (or endure) varies from hour to hour, from day to day, from year to year and from place to place. It is these variations which are important, but as soon as we try to represent the weather as a series of averages, we conceal the very facts we want to discover.

What is humidity?

Most people think they know what humidity is, but perhaps not all are completely sure of their facts. All air contains moisture in the form of water vapour. The amount of water vapour present in the air has an upper and a lower limit. The lower limit is obviously nil, and this state of affairs is never encountered in natural circumstances. The upper limit depends on the temperature of the air and it increases with increase in temperature, so that warm air can hold much more water vapour than can cold air.

The amount of water vapour present is often stated in terms of vapour pressure which is the contribution to the atmospheric pressure made by the weight of the water vapour. When the maximum amount of water vapour is present, the air is said to be saturated and the contribution is called the saturated vapour pressure. The way in which

this varies with temperature is shown by the following figures:

Temperature	80	60	40	20	°F
Sat. Vapour Pressure	35.0	17.7	8.4	5.6	millibars

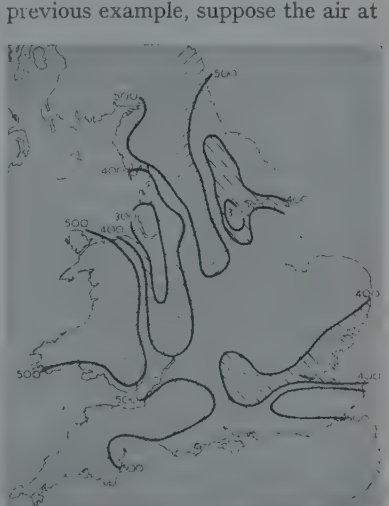
Vapour pressure is not a term which is much used outside professional meteorological circles; it is more common to hear the expression "dew-point", which is just another way of describing the same thing. Suppose we have air at 60°F which has a vapour pressure of 8.4 mb. If we cooled this air without altering the amount of water vapour present there would come a time when 8.4 mb. was the saturated vapour pressure and we can see from the above figures that this would be when the temperature had fallen to 40°F. In this case the dew-point is 40°F, the temperature at which the water vapour actually present in the air would be sufficient to saturate it. The dew-point is constant with change in temperature but varies if moisture content is altered.

A more common expression still is "relative humidity". This is a ratio, expressed as a percentage, of what moisture is present against what moisture could be present if the air were saturated. If a lecture-room held 177 seats and 84 of them were occupied, then the relative attendance would be $\frac{84}{177} \times 100$ or 47.5 per cent. In the above example of air at 60°F with a moisture content of 8.4 mb. vapour pressure when the saturated value would be 17.7 mb, the relative humidity is also $\frac{84}{177} \times 100$ or 47.5 per cent. The relative humidity alters both with change of temperature and also with change of moisture content.

This last fact is most important because it is often the relative humidity we wish to control, being as it is the factor which is important in growth and in the incidence or spread of disease. We can decrease the relative humidity by raising the temperature and vice versa.

The humidity climate

If we wish to represent the humidity climate of Britain it therefore seems sensible to do so in terms of relative humidity but it is by no means an easy thing to do. The actual moisture content of the air in any one day does not vary very much; it decreases a little during the night, especially if there is any dew or fog, and it increases a little by day due to the addition of water by evaporation. The temperature of the air, however, varies considerably and therefore the relative humidity also varies considerably in the opposite sense. Taking again our previous example, suppose the air at



Average duration of high humidity hours during June and July (1950-1954).

dawn was saturated at 40°F and the maximum day temperature was 60°F with the same moisture content (namely 8.4 mb). The diurnal temperature range is 20°F (40 to 60°F) and the diurnal relative humidity range is over 50 per cent (100 to 47.5%).

If we try to find the average daily relative humidity by adding up hourly values and dividing by 24 we get some odd results; for example the long-term averages for the month of August are:

Coastal Stations	
Valentia (S.W. Ireland)	84.7
Falmouth	82.9
Fort William	81.0
Sealand (Cheshire)... ...	80.7
Aberdeen...	79.5%
Inland Stations	
Eskalemuir	84.0
Cranwell	83.0
Glasgow	80.3

The high values at Valentia on the coast of Kerry or at Eskdalemuir, high up in the Southern Uplands of Scotland might have been expected, but it is a little disconcerting to find that at Cranwell in the centre of Lincolnshire it is, on average, damper than it is at Falmouth on the Cornish coast.

The reason for this is that on the coast in August it rarely gets very cool at night and therefore the relative humidity remains lower there than it does inland where there is more night cooling. By day the humidities are lower inland than on the coast, but at night the reverse is true. The daily average thus conceals the true facts.

If we consider only the observations at 1 p.m. in the afternoon and find the percentage of occasions when the relative humidity is 90% or more at that time a clearer picture emerges:

	Cranwell	*Plymouth*
Jan. ...	37	29
Feb. ...	28	24
Mar. ...	12	18
Apr. ...	11	17
May ...	9	16
Jun. ...	6	16
Jul. ...	9	24
Aug. ...	6	14
Sept. ...	8	17
Oct. ...	13	17
Nov. ...	37	23
Dec. ...	42%	24%

Thus for four months of the year November to February, Cranwell has more very damp hours in mid-afternoon than Plymouth, for the rest of the year the reverse is true.

The mid-afternoon humidity does not give the entire story, what may be important is the total time when the relative humidity is high. The map illustrated on page 107 shows the average direction of such hours in June and July. The important features of this map are the least humid areas which lie in the shadow of the Snowdon range and the Peak District.

Generally speaking these high humidity hours are least when the area is to the lee side of a range of hills, they are also least where the area is close to sea level. The increase with height can be considerable.

Indoor Humidities

To give a complete picture on these lines would need more space than is available here, but even if such were available it would only answer one of our three problems. There still remains the problem of the change in humidity which takes place when the outside air enters into a building.

The effect of any building if it is unheated is to decrease the amplitude of any temperature fluctuation. In other words it is warmer by night and cooler by day, but the mean temperature over 24 hours is very little different from that outside. Bearing in mind that alteration of temperature of the air immediately has an effect on the relative humidity, this means that inside an unheated building the relative humidities are likely to be slightly lower than outside by night and higher than outside by day.

The extent to which this change of temperature and hence the change of relative humidity takes place depends on the construction of the building, its degree of ventilation and the thermal conductivity through the floor, walls and roof. In a flimsy building the change will be small, in a more robust structure the difference will be greater. Inside a cave with thick insulation on all sides and little ventilation the temperature is almost constant and therefore there will be the greatest change in relative humidity if air from the outside is allowed to penetrate into the cave.

The changes in humidity from outside to inside are most important on a day when the external weather is close, cloudy and wet. As can be seen by the table showing the frequency of high afternoon humidities at Cranwell and Plymouth this occurs about one day in three inland in winter, and about one day in four on the coast. In summer inland the frequency drops to about one day in 12 and about one day in 6 on the coast. Indoors the frequency will increase, so that on such occasions the inside air will have a high humidity all day and all night—a state of affairs that can often lead to disease.

The only way to lower such relative humidities is either to extract the moisture from the air, which is generally difficult in anything other than a complete air-conditioning system, or to raise the temperature, which may be easier but less desirable.

Measurement of Humidity

Just as humidity is not easy to describe, it is also not easy to measure. The commonest method is to use a hair hygrometer, an instrument which can at times give misleading readings. Incidentally it is usually the hair of a blonde which is used and not a brunette, but it would be unwise to make any rash conclusions from this. The fact is that most hygrometers and hygrographs are subject to error, especially if, as is inevitable, the hair gets dirty.

Normally at official stations, humidity is measured by the use of wet-bulb and dry-bulb hygrometers; these give good results if they are exposed correctly and read accurately, the humidity being found by tables from the readings of the two thermometers. Inside a building it is generally necessary to blow air over the bulbs of the thermometers using some form of aspiration as in an Assman psychrometer which is an accurate but expensive instrument. Perhaps the best compromise is to use simple inexpensive methods of measurement and to check them regularly for accuracy with the expensive but more accurate types.

Conclusions

Like some husbands, humidity can claim to be a much misunderstood and a much neglected subject, and like some wives, it will probably repay careful consideration.

ROUND AND ABOUT

A VISIT TO HENFIELD

Nestling in the heart of the South Downs in the valley through which the river Adur makes its way to the sea, lies the still almost unspoiled village of Henfield. It is here that Mr. Doug Field operates his compact and obviously efficient 10,000 *square foot mushroom farm. Although only a relatively small-scale grower, Mr. Field has incorporated on his farm many progressive ideas, some of which might well be used to advantage by other growers.*

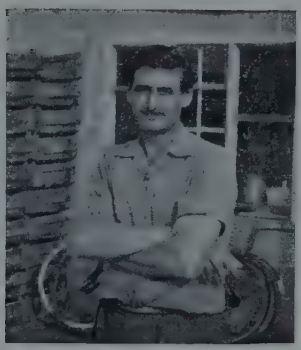
When Mr. Doug Field took delivery of his first load of stable manure he had just £39 in the bank—and the bill for the manure was £42! That was over ten years ago and today he has 10,000 square feet of cropping area under production on one of the neatest, cleanest farms in the country—and everything is paid for! This remarkable improvement in his affairs can be attributed very largely to his own hard work.

Mr. Field's father has been a market gardener in Henfield for many years and when his son Douglas was discharged from the R.A.F. in 1945 he took a course in general horticulture under Mr. Praill at the then Pullen-Bury's Nurseries just outside Worthing. He remarked that most of the course seemed to consist of dung-turning for the mushroom section and surprisingly Mr. Field became interested in mushroom growing. When he joined his father at Henfield in 1948 the annual mushroom catch-crop became his speciality.

Soon he persuaded his father to let him have a corner of the market garden where he could grow mushrooms all the year round, initially in his spare time. The seed of his farm was a Handcraft Watford Hut which he built himself and he claims that it was this house that paid for everything else on his farm. The original house is still standing and yields excellent crops as we could see when we visited the farm.

While continuing to work on his father's holding, Mr. Field and his wife set to work to raise their first crop of mushrooms. They had shelf beds in their single house, and although yields were not outstanding, they paid their way and the "overdraft" disappeared. It was the introduction of peak-heating, he claims, that really improved his yields and he remembers the braziers that were used and how he and his wife would stoke them up at 11.30

Mr. D. G. Field, to whom we are indebted for receiving us and providing the information on which this article is based.



SUSSEX

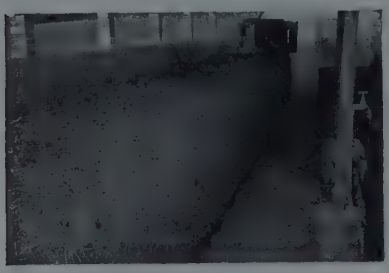
at night, pushing a crowbar through the holes from side to side and bumping them up and down. Looking back now he thinks there was a great deal to be said for peak-heating with braziers. He liked to fill on the wet side, and the raw, dry heat from the burning coke could be relied on to bring the compost up to the right condition.

Today he makes a true rapid compost in his roofed-over manure shed and when we arrived at the farm he was busy with two men stacking and soaking the newly delivered stable manure. Unlike the Duke of Plazatoro, he believes in leading his team from the front, and setting the pace by example. The unit on the farm is a 45 cubic yard lump of manure which, after composting and pasteurising, gives him roughly 1,500 square feet of trays.

During stacking and wetting, Adco "M" is added at the rate of 40 pounds to the ton, and the first turn is made 24 hours later, usually on a Friday. A new Chatsworth Colt manure turner with the wide elevator is used for this and subsequent turns, which take place on Monday, Wednesday and Friday. Filling then takes place on the following Monday—eight days after the first turn. The compost passes through the machine into the trays for a final aeration.

The only fault Mr. Field finds with the turner is that it tends to throw compost into the centre of the heap, and no matter how much effort is put in on the delivery side to drag it out to the full width of the pile the centre of gravity will always be in the middle of the lump, giving rise to anaerobic areas. To counter this Mr. Field has designed a "ridger", rather like the ridger used for earthing up potatoes. This will be fitted above the discharge roller and should have the effect of throwing the turned compost towards the sides of the heap rather than the centre. This will mean a light, open centre to the heap, with firm walls on either side, an essential factor in successful rapid composting.

For filling a hood is fitted to the turner, and the trays are placed beneath it, standing on the end of a line of roller conveyors. After filling, they are just levelled off and not compressed, and run along the conveyors to the heat room. Here they are removed and stacked eight-high on pallets. Some sixty extra trays are filled and processed, to be used



The curing shed is roofed over, with a half-wall on the south-west side. The opposite side is open.

for topping up the cropping trays after pasteurisation.

The rapid composting process is nothing without a proper heat room, and Mr. Field has appreciated this point by spending and continuing to spend a lot of money in making the best heat room possible. The walls are of double thickness, with concrete blocks on the outside and lignicite insulation blocks on the inside. The ceiling is of asbestolux, with fibreglass insulation above, and Foliac Graphite Paste has been used to seal the room against vapour and moisture. It is a scaled down version of the heat rooms found on the biggest intensive farms and there can be no doubt that it is worth every penny spent on it.

The trays are close-stacked and as they are fitted with 2-inch corner pegs or "ears" there is enough room for air to circulate between them. The house is closed down and high-pressure steam is turned on until a temperature of 136° is reached, while a 16-inch Tornado circulating fan equalises the temperature at all levels.

The only thing remaining to complete this model heat room is the installation of ducting, and this is being carried out at the moment. In the interim period the rough and ready method of ventilating has been to open the door a few inches to admit fresh air, while maintaining the temperature by injecting more high-pressure steam.

Pasteurisation usually takes about three days and is continued until there is no trace of ammonia. Then the stacks of trays are removed on their pallets by a Geest stillage truck, unstacked, spawned, re-stacked and taken to the spawn-running room.

At present the trays are spawned by hand, although a spawning machine is being constructed to Mr. Field's design and should be ready soon. Grain spawn is used at approximately one carton to thirty square feet, and is cast over the surface of the compost and then mixed in with the fingers to a depth of about four inches.

For a spawn-running room, Mr. Field has cut one of his growing rooms in two, using one end as a covered peat store. As the trays are still close-stacked the complete cropping unit of 1,500 square feet can be placed conveniently in this half of a house.

After eleven days the trays are cased. The casing medium is a mixture of equal volumes of granulated peat and kibbled chalk, mixed in a special casing materials shed. After casing the trays are moved on their pallets into the growing house, and then stacked checkerboard-fashion for cropping.

Mr. Field now has six growing houses, each taking around 375 fish trays. The original house was a Handcraft Hut as already mentioned, and he followed it with two Universal Big Six houses. All are insulated externally with Fibreglass and roofing felt.

The heat room. Note the Geest stillage truck loaded with 16 fish trays.

Next Mr. Field put up some purpose - built houses — two blocks of two. The basic building material used was the Lignicite block and all external walls are of double thickness with an insulating cavity between the skins. They have false ceilings of asbestolux, with Fibreglass over.

At this point we asked Mr. Field about the heating of his farm and he showed us the 600,000 B.Th.U.Hr. Ideal Boiler with oil firing which provides the hot water for heating the growing houses. Each of these houses has a single run of 2-inch gilled tubing along each wall, with a plain return of 2-inch piping. The boiler is more than adequate for the farm as it stands today but this over-insurance means that Mr. Field need have no heating worries for some way into the future.

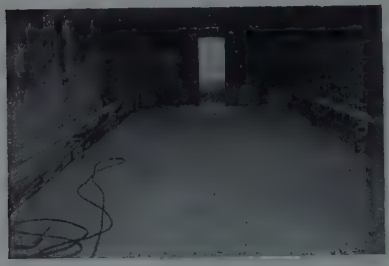
For steam he has a Marshall Loco Boiler, rated at 1,000 pounds evaporation, giving steam at 80 pounds per square inch. The steam is led off to all parts of the farm in 2-inch piping and every house has a steam cock and valve. The use of high-pressure steam during pasteurisation has already been mentioned.

The growing house temperature is maintained at 62°F. and the casing is not watered until the spawn has grown about a quarter of an inch up into it. Then the first good watering is given. Mr. Field goes for plenty of overlay, lots of pin-heads, and he likes to "crop off the top".

The spring and early autumn are the most difficult times for growing, Mr. Field claims, and points out that it is at these times that one hears of "trouble", call it what you may. The reason lies, he thinks, in atmospheric conditions that are not fully understood by growers. High humidity and high temperature can together set up a problem in crop management that at times seems baffling, and he instanced the spell recently when continuance of the normal bed watering undoubtedly resulted in gross over-watering and damage to the mycelium.

Before inspecting the picking and packing arrangements, we asked Mr. Field about sanitation at the end of cropping. He said that first the house and compost were sprayed with formaldehyde solution. Then the house was closed down and the heat turned on, with high-pressure steam injection until a temperature of 160-170°F. was reached. This temperature was held for about ten hours.

The house was then emptied as quickly as possible, the trays being tipped straight into a lorry and the compost removed without delay. The trays are then heat sterilised in the heat room before going back into use, while the empty house is scrubbed down with water and stiff brushes, and then sprayed with S.D.N.O.C. To illustrate the speed at which they work, Mr. Field said that it took less than an hour to empty and remove the compost of his cropping houses.



The interior of one of the new growing rooms, with a single run of gilled tubing along each wall.

And so to picking and packing, an aspect of the growing business to which Mr. Field gives special attention. Here we come up against a number of contradictions, the first of which is that Mr. Field finds it best to use men for picking rather than women. Faced with a heavy flush to clear, he and two men tackle the job in the house, while the women deal with the mushrooms in the packing shed.

They go over the beds, picking off everything except the small and damaged mushrooms. They can clear the beds at the rate of about 40 pounds of ungraded mushrooms an hour. Later, when the more valuable part of the crop has been packed and cleared, they return to pick what is left.

In the packing shed the mushrooms are graded into "Cups", "Open Cups" and "Flats". These comprise the best mushrooms and the balance are marketed as "Mush", for those marked or damaged, and "Rooms" for small buttons. Although the grading is simple, the standard is high, and every mushroom is placed in the chip so that the finished basket presents a handsome picture.

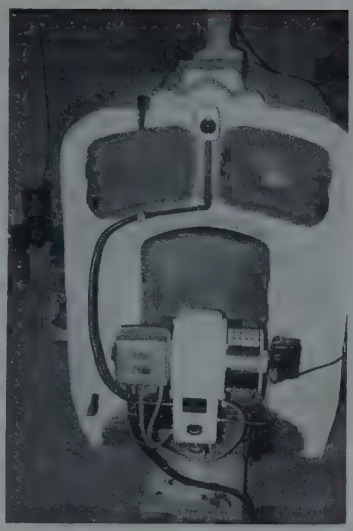
Six sheets of blue paper are used for every chip so that the contents are completely enclosed. Apart from the excellent appearance this gives the mushrooms, it also has an effect on the keeping quality of the produce. The fact is that Mr. Field is getting on average 6d. to 1s. per pound more for his mushrooms than most people, and buyers are asking for his baskets by name, a sure sign of good grading and packing.

The mushrooms go to market in a cardboard basket, and here we have the second contradiction. Mr. Field says that he finds that market salesmen prefer these cardboard chips because they stand firmer and stack better. He certainly gets a better price for his mushrooms than many, and he finds he can get more mushrooms into a cardboard basket than into a veneer chip, so that with the lower price he has to pay, he certainly has no regrets on the matter!

As might be expected on this small, if modern mushroom farm, he has built and equipped a cold store. Bearing in mind what we have heard on other farms, we asked if he found cold storage detracted from the market value of the mushrooms. He claimed that it made no difference, and that so far as the appearance of his mushrooms went, 48 hours in the cold store did not seem to alter them at all. But he does think that this is due to the total enclosure of the mushrooms in blue paper—an advantage that can be added to enhanced presentation of the product!

If there is not a heavy pick on a Friday, he will hold both Friday's and Saturday's mushrooms back in the cold store, dispatching to the market on Sunday to catch the Monday market.

The 600,000 B.Th.U. Ideal Boiler which provides the hot water for heating the farm.



He sends principally to Brentford and to Covent Garden, and the choice is influenced by prices.

His farm is staffed by two full-time exceptionally good men, two part-time women, and an old age pensioner who comes in twice a week. He himself takes an active part in the running of the farm, and his wife, who has helped him from the start, gives a hand with the packing and dispatch.

For the future? Mr. Field wants to consolidate what he has already and he has no plans at present to expand his actual growing area. He feels that there is plenty to be done to increase the efficiency of the existing set-up, starting with the ducting in the heat room. More concrete is required, more roads, and then there is capital to be put into replacing his fish trays with purpose-built trays for open-stacking.

Mr. Field is one of several keen young growers in the district who are all thinking alike in their future plans. They will be the next generation of the big growers and it will be interesting to see what they make of the industry they will inherit.

A NEW 'COMPACT'

A revolutionary new tractor that will have considerable appeal to the mushroom grower and nurseryman has been introduced by Lea Francis Cars Ltd. of Coventry. It is only 31 inches wide and 5 feet long, yet it will tow loads of up to 2 tons.

It is a sturdy compact unit powered by a 7 horsepower single cylinder, air-cooled engine, with obvious advantages in economy of operation and ease of maintenance. This power-unit is made by B.S.A., and is mounted on a steel chassis which includes car-type steering, a combined brake and clutch control and a hand-operated throttle.

Christened the "Unihorse", the tractor can be used for such work as grass cutting, rotary cultivation between rows of plants, and also for general haulage work. There is a power take-off for operating equipment such as circular saws and lifting gear.

The tractor has been thoroughly tested on farms in the Coventry district and has proved its worth for ploughing. It has exceptional ground-holding ability and it is almost impossible to turn it over, even on the steepest slopes.

"Spent compost . . . . . is a most valuable manure and has, in fact, more manurial value than freshly composted manure. No grower should overlook this important side-line . . . . . "

MUSHROOM FARM CHANGES TO TRAYS

by NORMAN L. GOODLAND

We are indebted to the Editor of the "Commercial Grower" *for permission to reproduce the follcwing article which we think will be of special interest to growers for Mr. Collins is a practical grower with some sound opinions on practical problems.*

SOME time ago "The Grower" published an account of the reorganisation of the Merry Orchard Mushroom Farm at Whiteparish in Wiltshire. This was in 1957, so recently I visited the farm to see what progress had been made in the last four years.

At the time of my visit, the management was changing over from growing mushrooms in beds to using the tray system. It was decided to do this because it is an easier method of handling; a larger area can be cropped without a big increase in staff. And there is, of course, easier control of disease, since, if such a mishap occurs, the trouble spot can be isolated more effectively than is the case when using beds.

"With beds," says Mr. Bernard Collins, the manager, "it would take a week to clear a house and sterilise. Trays cut this time to as little as one day."

Women are preferred for the actual handling of the mushrooms. "They are quicker," says Mr. Collins, "and more adapted to handling mushrooms. The men are outside doing heavy work, which they prefer."

I saw men preparing the compost for the sterilising chamber and here

Trays moving along a conveyor line to the heat rooms for pasteurisation.

At Merry Orchard Mushroom Farm a Comporato is used for turning the compost.

there has been definite improvement. Trays are loaded quickly at the site of the compost heap after passing through the turning machine, and run on rollers straight down into the sterilising room. A mechanical loader also takes the trays out and places them in position in the houses.

"There is a big drive by the industry," says Mr. Collins, "to educate the public in the proper use of mushrooms and their by-products.

"People go in for buttons because they are so white and fresh, but, of course, they are not always the best buy. You cannot fry a button properly, or a cup. If you are going to fry, then the open kind should be bought; they fry properly and are better flavoured, used in this way.

"Buttons are excellent, of course, for other methods of cooking, their best use being for sauces, salads, pickling and garnishing. If mushroom sauce is contemplated, it is no use buying open mushrooms, because the pink gills will discolour the sauce.

"For soups, stuffing and as a vegetable, cups are ideal.

"We try to put these points over to the public by illustration and instruction on our packages," stated Mr. Collins.

"Public taste naturally reflects on sales," he added. "We have five different grades according to shape, size, use and so forth, so that the housewife can choose, where we market, the mushroom she prefers. But I do think some work is needed in getting the public to be discriminating in their buying. They would be more satisfied and, of course, it would help the efficient grower."

Mr. Collins returned to this theme in regard to spent mushroom compost.

"This is a matter which ought to be pushed," he said. "Some growers hardly know what to do with it. Yet it is a most valuable manure and has, in fact, more manurial value than freshly composted manure. No grower should overlook this important side-line if he is producing in any quantity.

"The public should be told that the mushroom does not feed on the same ingredients as plants, thus setting at rest any fears that the compost may spread disease. Mushroom compost is sterilised before removal in the interests of hygiene on the mushroom farm, but even if it were not, diseases which affect mushrooms do not affect plants. It is, in fact, in first-rate condition owing to its maturing for a long time and the treatment it receives; it has a high nitrogen content, potash and trace elements, and is quite free from weeds and seeds. It is also clean and sweet smelling, nice to handle and easy to spread."

He said that here again the public should be told how to use it. It

Mr. Bernard Collins, manager of Merry Orchard Mushroom Farm, holding a sample of the mushrooms he produces.

should not be used for plants which object to lime, because of the lime in the casing material. But for digging in, Mr. Collins suggests ½ cwt. to about 250 sq. ft.; for mulching, the same weight to a row of plants 100ft. long, or larger quantities if the ground is poor.

Too much cannot be used, because it is thoroughly composted and stable.

"It is especially useful for strawberries," he pointed out. "Show marrows can be grown on it; tomatoes thrive on a mixture of half compost, half soil, and it keeps seed boxes at exactly the right moisture content, as well as providing an ample supply of nutrition to the seedlings.

"It should not be used as a mulch under cloches, because it will dry out; but it can be dug in beforehand, or the compost can be put down on each side of the cloche.

Good for lawns

"It is an excellent medium for putting the lawn to bed for the winter in good condition, say one sack to 350 sq. ft. in the autumn after the last cut. If one combines it with grass mowings, this is ideal for the lawn or garden during autumn. It is quite easily stored —in a sack, if kept moist, but, of course, not wet."

Merry Orchard has extended to nine houses, with a total area of 18,000 sq. ft.; six women are employed, with three men on the outside work. The management is anxious to avoid any impression that it is a remarkable farm.

"We reckon," says Mr. Peter Danks, one of the directors, "to be a reasonably efficient farm for our size, and, although we are satisfied with our average production of 8½ lbs. per sq. foot per year, we hope that new methods will help us to improve on this."

Some items of interest from our Postbag

Spawning Rates

I have read a lot recently about heavier spawning giving better results. What rate of spawning do you recommend for your grain spawn?

When grain spawn was first introduced in this country the grains were simply cast on the surface of the compost, with the result that one carton would go a long way. Initially the rate recommended was 50 square feet to the carton, and growers who still use this method of spawning can continue to spawn at this rate.

However, it has been found that spawn run is faster if the grains are mixed through the compost, and obviously the faster the spawn run, the sooner cropping will commence and the more mushrooms will be picked in a given period. Furthermore a fast spawn run suppresses some moulds that may inhibit cropping if allowed to develop, so that overall yield can be increased.

To mix spawn thoroughly into the compost means that more spawn must be used to ensure that there are initial points of mycelial growth at all levels of compost. The heavier the rate of spawning the closer these points are and the sooner the whole of the compost will be run with mycelium.

For light spawning, therefore, one carton of our grain spawn can be used for 50 square feet. A medium spawning rate, such as where the mixing is done by hand into the top layers of the compost, would be 30 to 40 square feet to the carton. Heavy spawning, such as when a machine is used for thorough mixing, would be 20 to 25 square feet per carton.

You can test for yourself the effect of a heavier spawning rate on cropping by doubling the amount of spawn mixed into one or two trays in a batch. These trays will come into crop well before the rest of the house.

Bubble

I have a lot of bubble on my trays, and do not seem able to shake off the infection. Should I start sterilising my casing, or can you suggest any other steps I should take to get rid of this trouble?

Although the commercial mushroom grower may think it a somewhat dogmatic statement the fact remains that a persistent and well-established Bubble infection on a farm is almost always the result of too little attention being paid to the small initial outbreaks of the trouble. Growers fail to appreciate how highly infectious this disease is. Once this fact has been realised it follows that the larger the farm the greater the facilities for spreading the trouble by workmen, pickers, chip baskets, tools, forklifts (and similar wheeled machinery) and motor traffic. There is thus a constant source of reinfection going on and the control of the disease involves not only the obvious course of treating the infected house or houses but also a long term policy of general sanitation over the whole farm.

Mycogone is a solid contaminant and in most cases of the disease on a mushroom farm the *original* source of infection comes from soil. Where casing soil is used this constitutes the most obvious method of introduction and it was to avoid contamination that growers were always enjoined to use second spit soil. With the introduction of peat and chalk as a substitute casing medium it has been a constant source of error by growers that Mycogone could no longer be a menace.

Peat and chalk can unfortunately be just as easily infected by Bubble. Peat can be suspect, especially if carelessly dug or stored and we have often seen beds cased with peat with weed seeds growing freely in it—an obvious demonstration of the presence of top spit material being present. Chalk supplies left lying unprotected on the farm will become infected by wind-borne spores or by careless workmen walking over it. Flies carry the infection from infected beds on the same farm or from neighbouring infected nurseries. The same remarks apply to the casing material when formulated—many growers make up large quantities of peat and chalk sufficient for several casing operations with the result that the material lies about on the farm unprotected for long periods.

Control of Bubble disease, once it has appeared on a farm consists in confining the infection to the affected house or houses and preventing a carry-over of the disease from one crop to another. In other words it involves eradicating the trouble from the farm and then preventing its re-entry.

Where moderate infections occur one employee should, if possible, be detailed to go round the farm before picking starts and take out all infected mushrooms, putting them immediately into a bucket of strong disinfectant. This operation helps to prevent pickers carrying the disease all over the farm and into the packing room on clothes, footwear, and picking baskets. After finishing his job the workman responsible for removing the infected crop should wash his hands thoroughly. As soon as possibly after clearing off the diseased mushrooms the beds should be thoroughly dusted with 75% Zibimate which will help to prevent the germination of *Mycogone* spores unavoidably scattered during the clearing process. If possible the house cropping temperature should be reduced to 55°F.—58°F. as such temperatures will not seriously slow down mushroom production but will definitely slow down the growth of Bubble.

After cropping, to avoid the serious danger of spreading infection from spent casing, etc., the cropping house and contents should be cooked out. The thermal death point of *Mycogone*, as established by E. B. Lambert, is 106°F. for some 6 hours and the efficiency of the cook-out can be increased by spraying out the house and its contents with 2% formaldehyde solution before introducing the heating method.

As already indicated, strict sanitation around the farm should be maintained, pathways, etc., should be sprayed with formaldehyde and the packing room and contents could, with advantage, be fumigated with formaldehyde gas—the peat/chalk mixing shed should also be treated.

If the incidence of the disease is severe it would also be an advantage to subject the peat/chalk mixture to heat treatment before casing is carried out.

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FRANCIS NICHOLLS, LTD., Smithfield Market. Birmingham. Tel.: Midland 6001 (12 lines), Telegrams: Nicholls, Smithfield, Birmingham.

Blackburn

SOMERS & GIBSON, LTD., Wholesale Market, Blackburn. Tel.: Blackburn 44956. Telegrams: Harty, Blackburn.

Covent Garden

BROOME & GREEN (LONDON) LTD., 27 James Street, Covent Garden. Tel.: Temple Bar 7856 Telegrams: Bourgaize, London.

CHARLES KNIGHTS, LTD., 501, 2, 3, 4, 5 Central Market. Tel.: TEMple Bar 5272, 9867

Manchester

SOMERS & GIBSON, LTD., Smithfield Market, Manchester 4. Tel.: Deansgate 3666. Telegrams: Muscatel, Manchester.

Manchester

FRED BRIDGE, Smithfield Market, Manchester 4 Tel.: Deansgate 4835 & 2802. Telegrams: Fred Bridge, Manchester. Established 1888

Sheffield

J. C. LUCAS & SONS, LTD., Castlefolds Market, Sheffield. Tel.: Sheffield 22618.

Spitalfields

CHARLES KNIGHTS, LTD., 220, 2, 3, Brushfield Street. Tel.: BIShopsgate 6848/9.

Stratford

CHARLES KNIGHTS, LTD., 24, 25, 26, 27 Channelsea Road. Tel.: MARyland 2070.

Wolverhampton

H. GOODALL, LTD., Wholesale Market, Wolverhampton. Tel.: Wolverhampton 26661/2/3. Telegrams: Goodall, Fruiterers, Wolverhampton.

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(SOUTHERN COUNTIES)

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STABLE MANURES LTD., Moulton, Newmarket. Tel.: Kentford 343

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